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Maritime Border Control

SCI-174 Workshop "Tactical Decision Making and Situational Awareness for Defence Against Terrorism"

Turin, 8 May 2006

Antonio Levato

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Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
01 MAY 2006	**N/A**	**-**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Maritime Border Control	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **SELEX Sistemi Integrati SpA Via Tiburtina Km 12,400 00131 Rome ITALY**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release, distribution unlimited

13. SUPPLEMENTARY NOTES
See also ADM202346., The original document contains color images.

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**UU**	**59**	

Homeland Security Mission

- The mission of ***Homeland Security*** systems is to minimize a Nation's vulnerability through the most effective defense: it is not possible to protect any infrastructure or to control a single visitor, but it is possible to reduce risks at a tolerable level, not to have any meaningful impact on society and economy
- However, should a risk come into effect, systems will have to allow an effective crisis management and recovery
- **Selex SI is capable to optimize the effectiveness of the SOS* through:**
  - Requirements analysis
  - Functional analysis
  - Architectural definition
  - Risk analysis
  - Value analysis
  - Modeling and Simulation

  allowing and complete plan definition and management

  ***SOS: System of Systems**

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Selex-SI System Design Approach for Maritime Border Control

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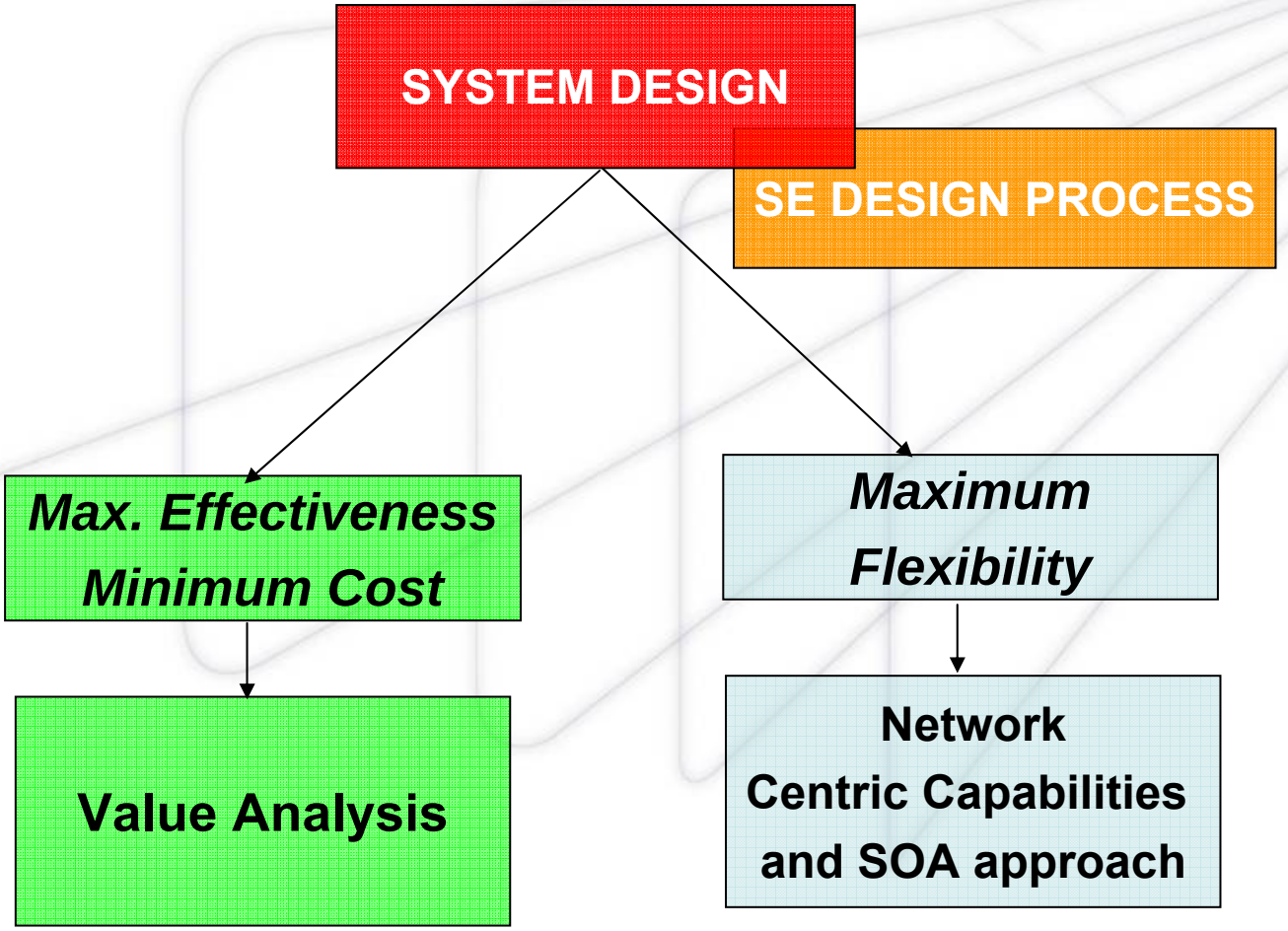
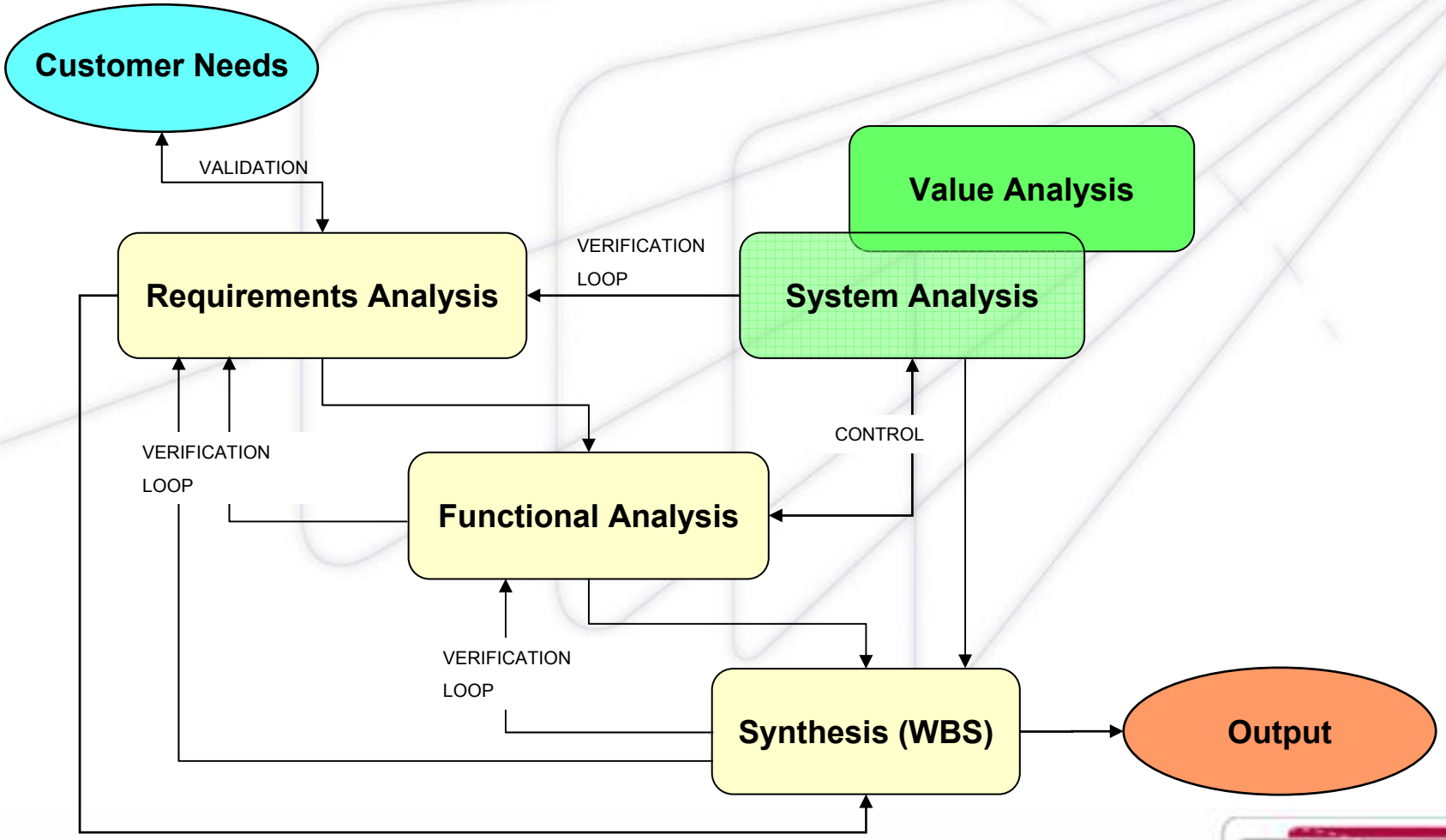
Selex-SI Approach



System Engineering Design Process



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Value Analysis

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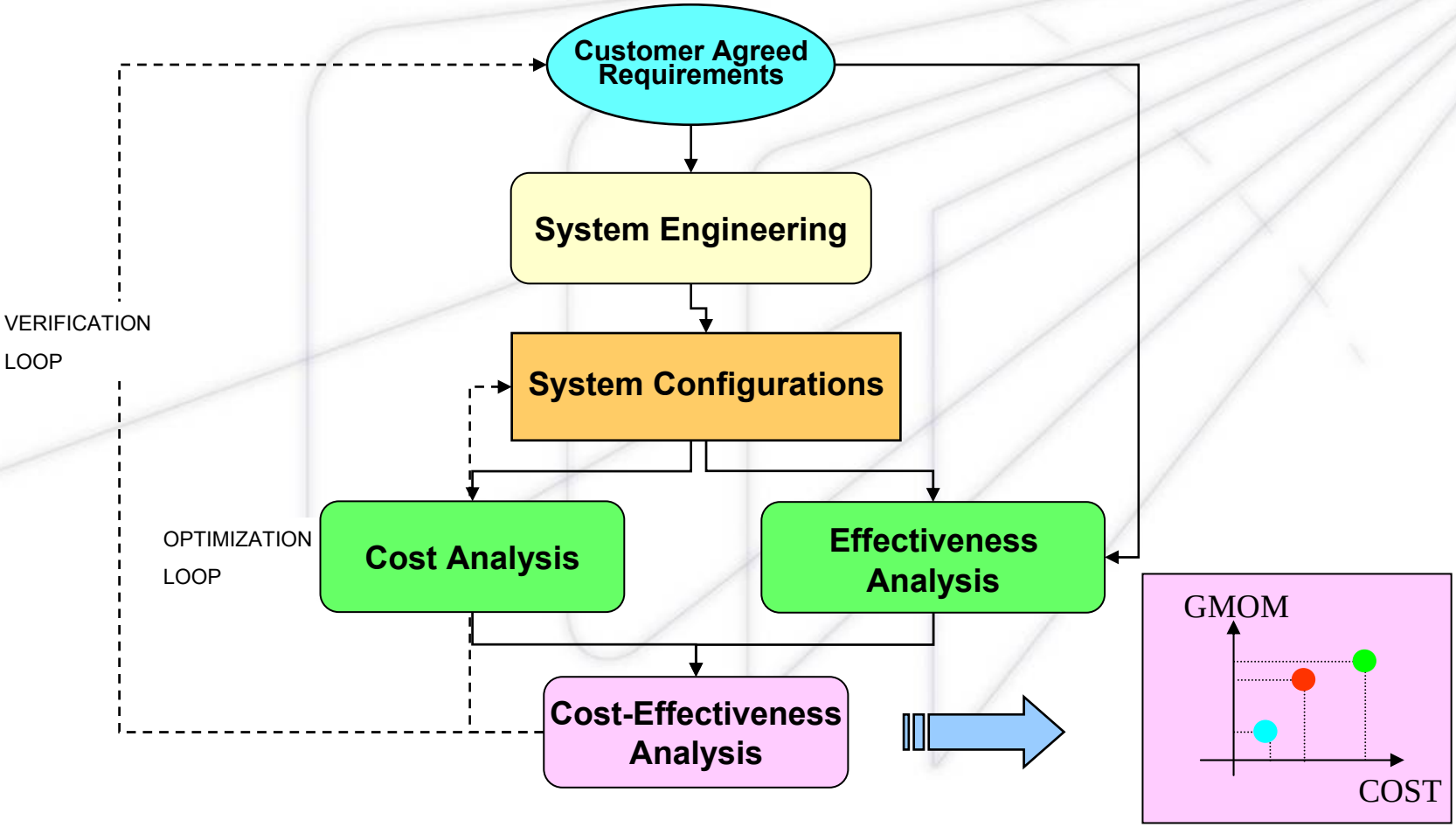
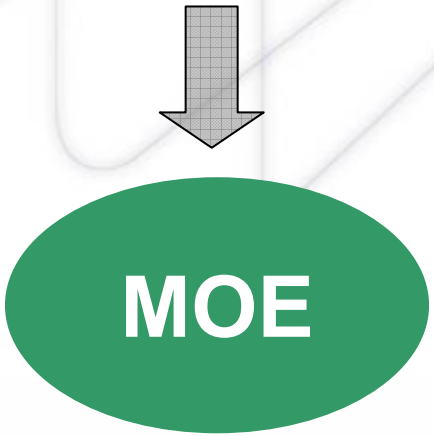
Value Analysis



Value Analysis – Effectiveness Analysis

- The main mission of the CSS System is to provide surveillance and protection of the Area of Responsibility.

- The **Effectiveness** of this mission is **the capability of intercepting suspected intruding targets at a suitable distance from the coastline border.**



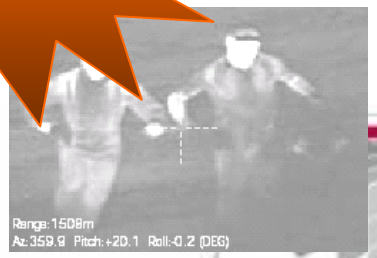
Threats to Homeland Security

The cycle of Surveillance

Surveillance

Identification and Evaluation

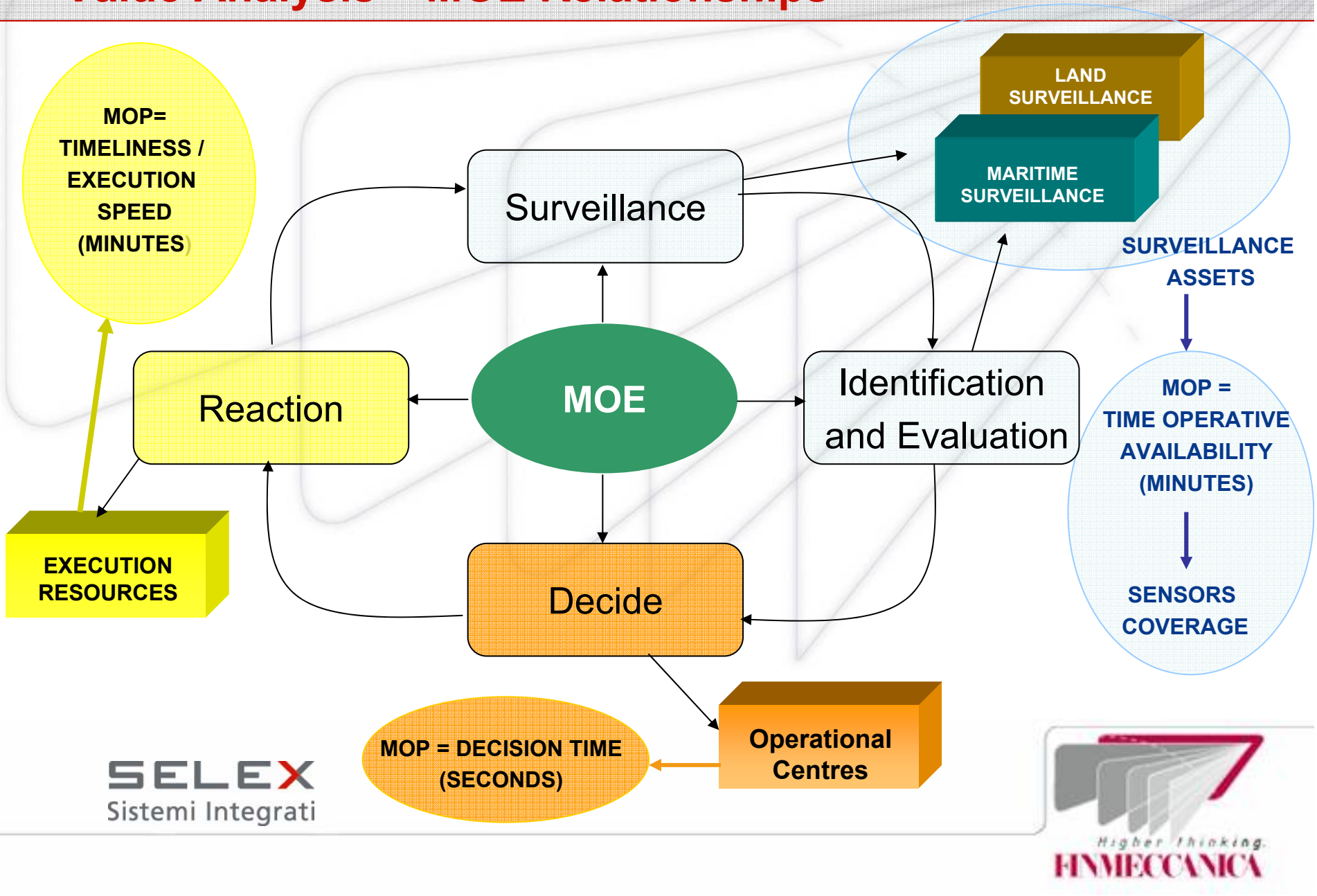
Threat!!!



Reaction

Recovery

Value Analysis – MOE Relationships



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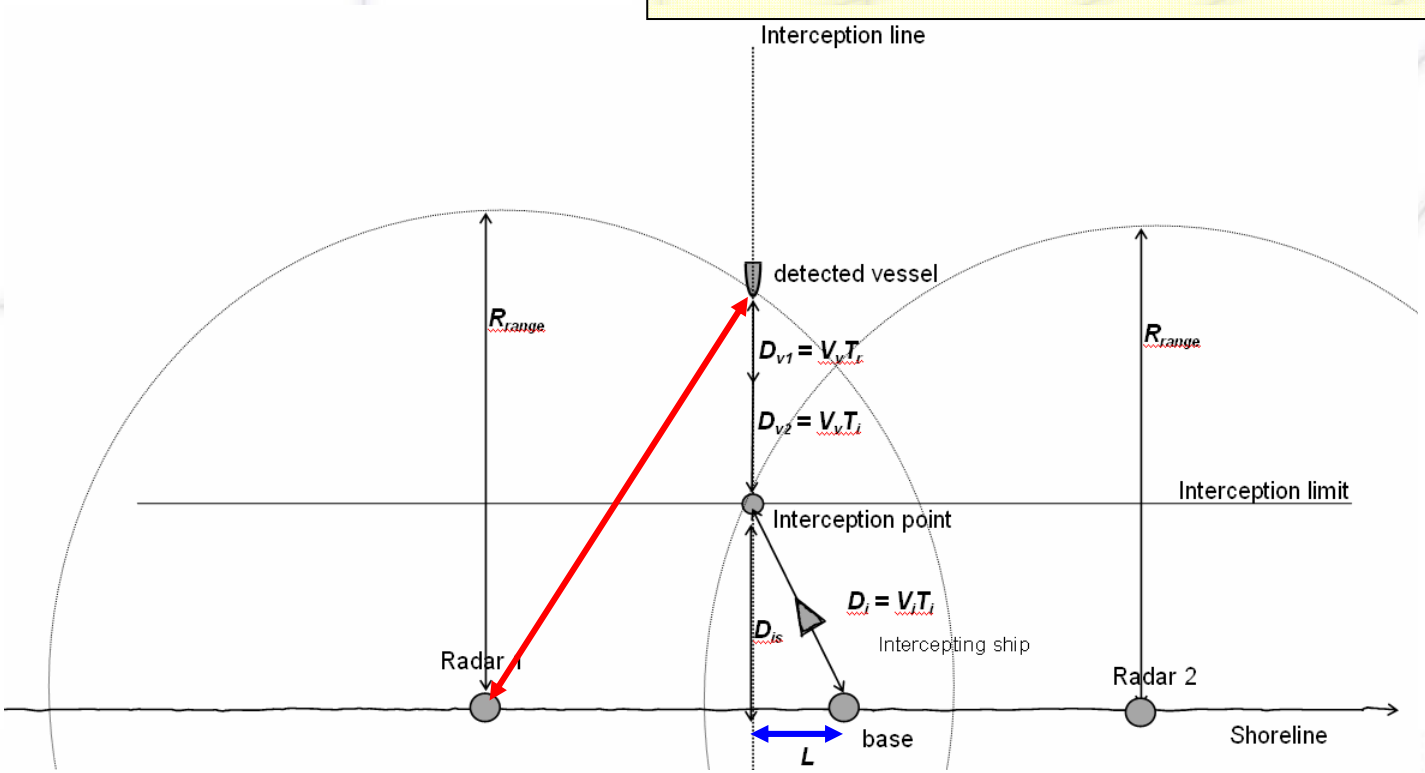
Main Functions Modelling

MOP

- Distance base-interception line
- Intruder/Interceptor speed ratio
- Detection Range→ Time Operative Availability



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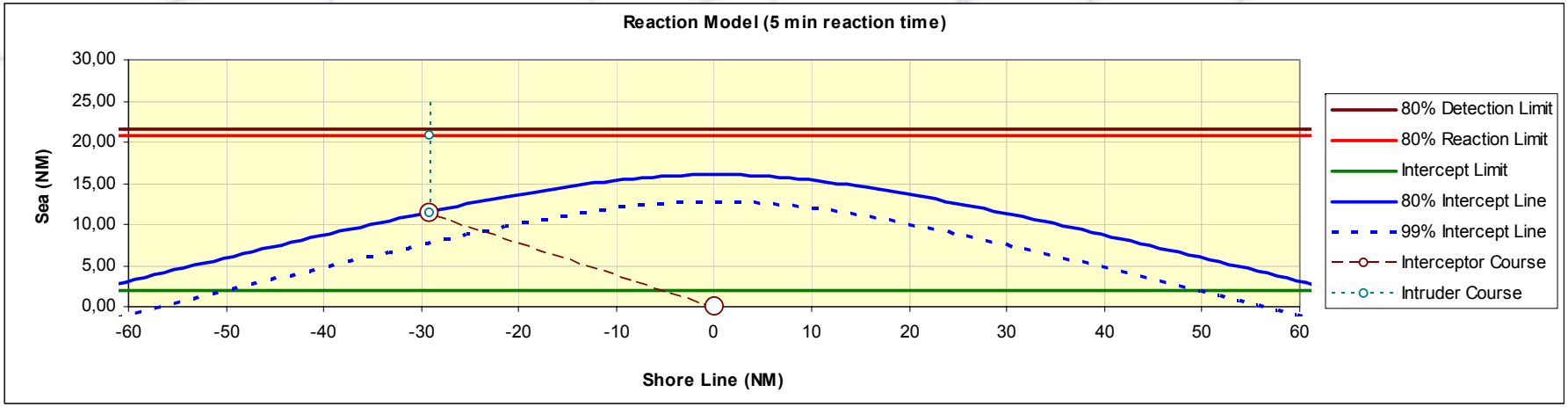
Main Functions Modelling

Detection and Reaction Capabilities Results

Considering a reaction time of 5 minutes a 80% interception is guaranteed for intrusions displaced from the interceptor location up to 63 nm, while a 99% interception is guaranteed for intrusions displaced from the base up to about 50 nm from the interceptor location



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Network Centric Capability and SOA Approach

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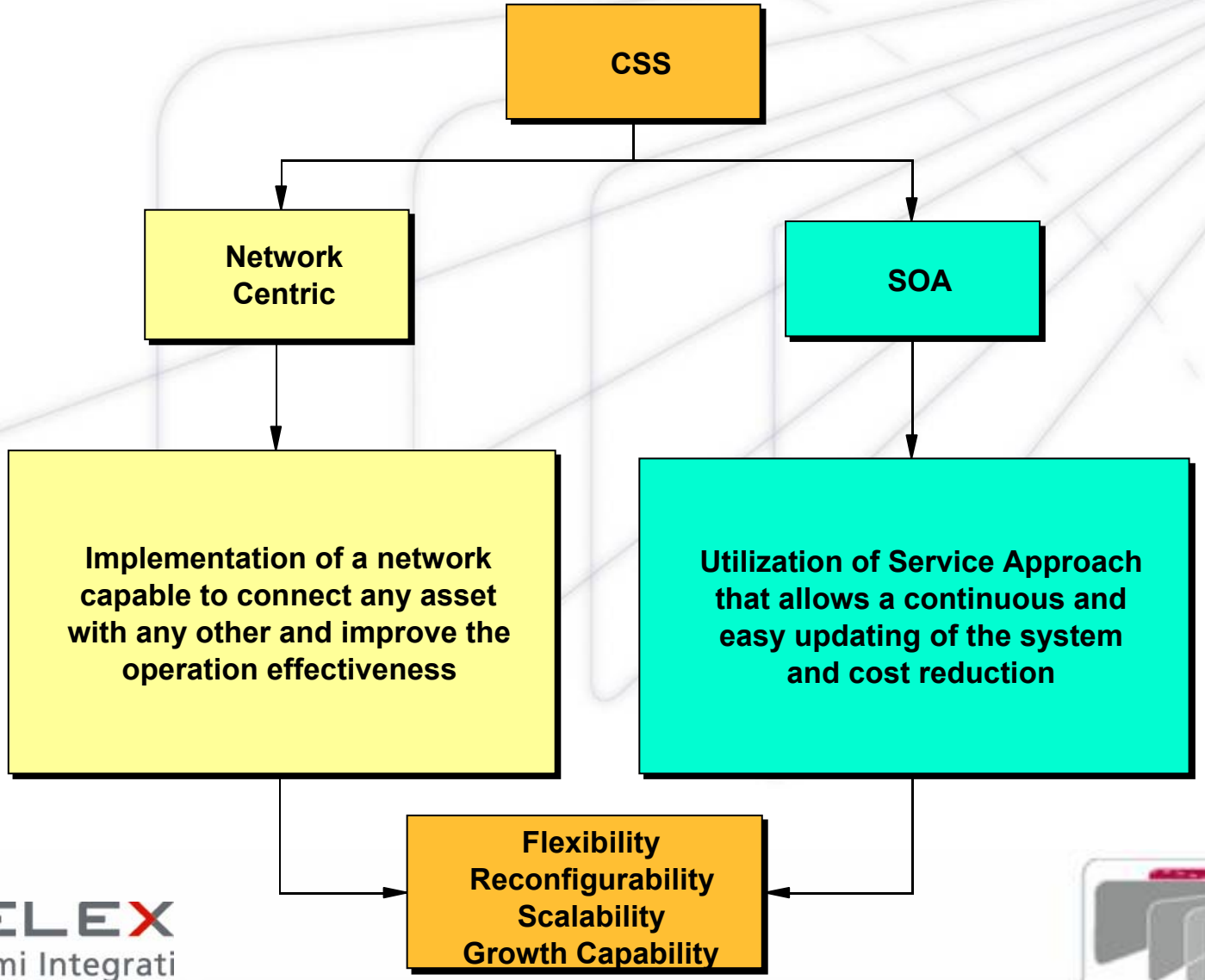
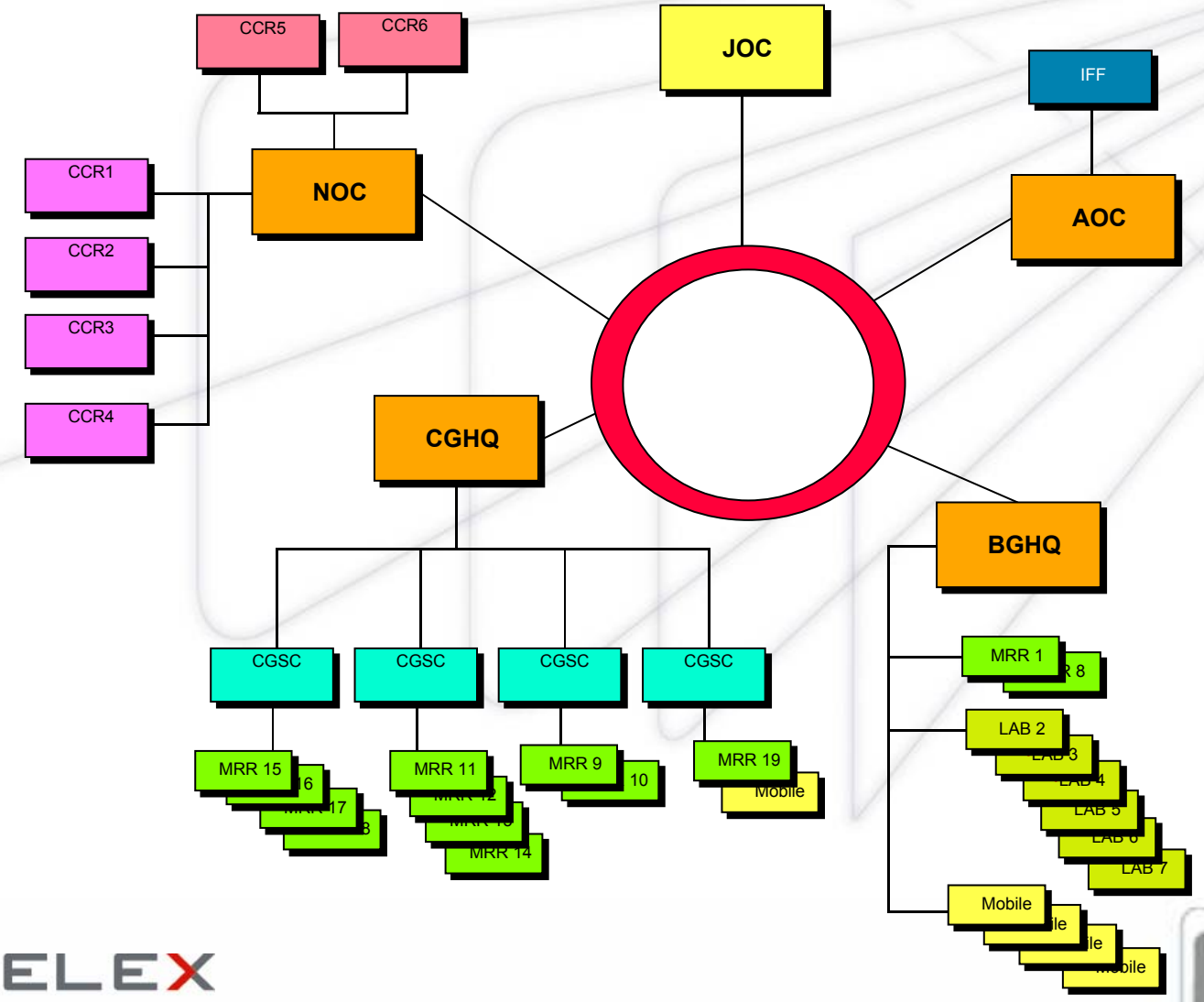
Network Centric Capabilities



Network Centric Capability: System Architecture



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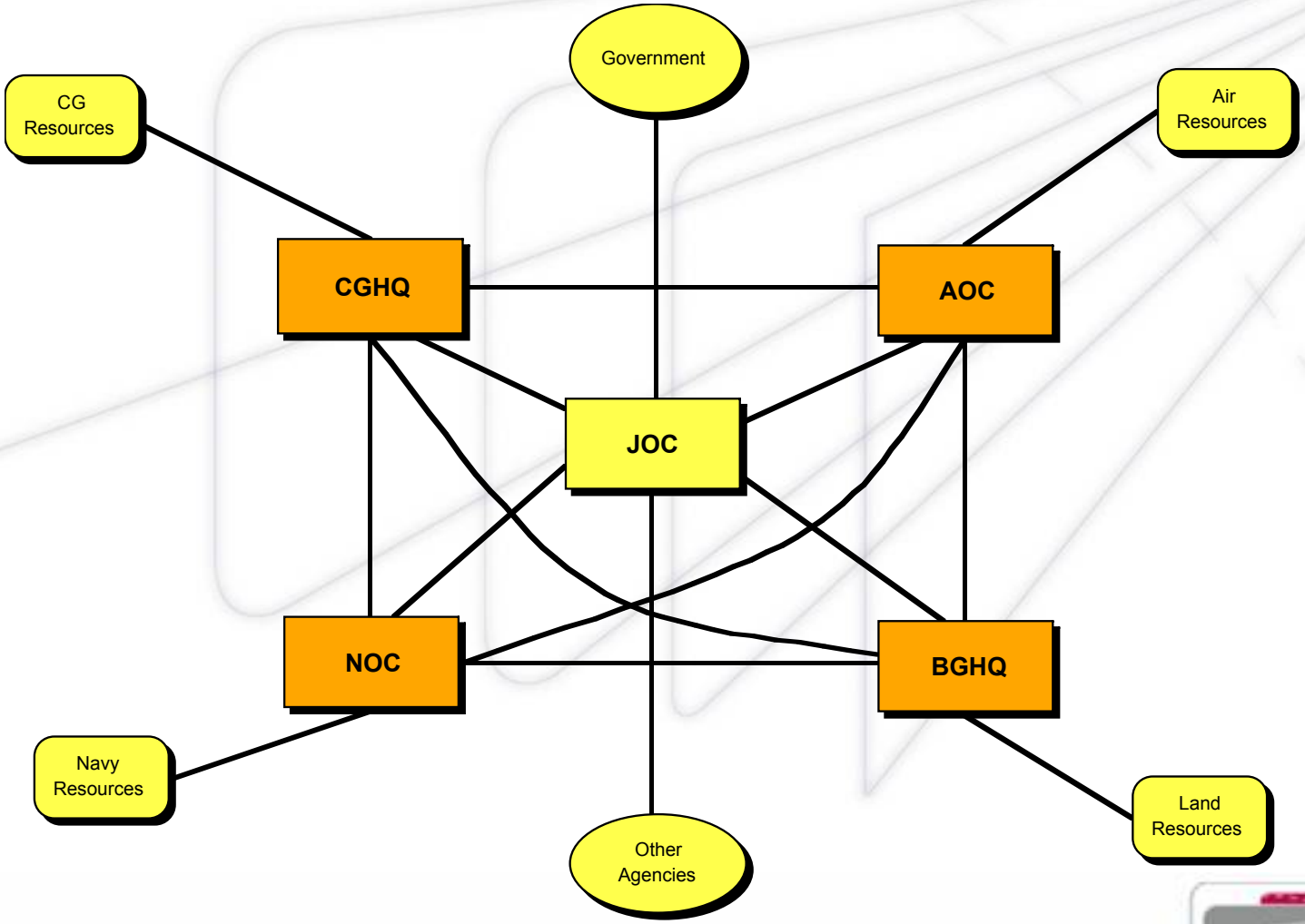
Network Centric Capability: Interconnectivity



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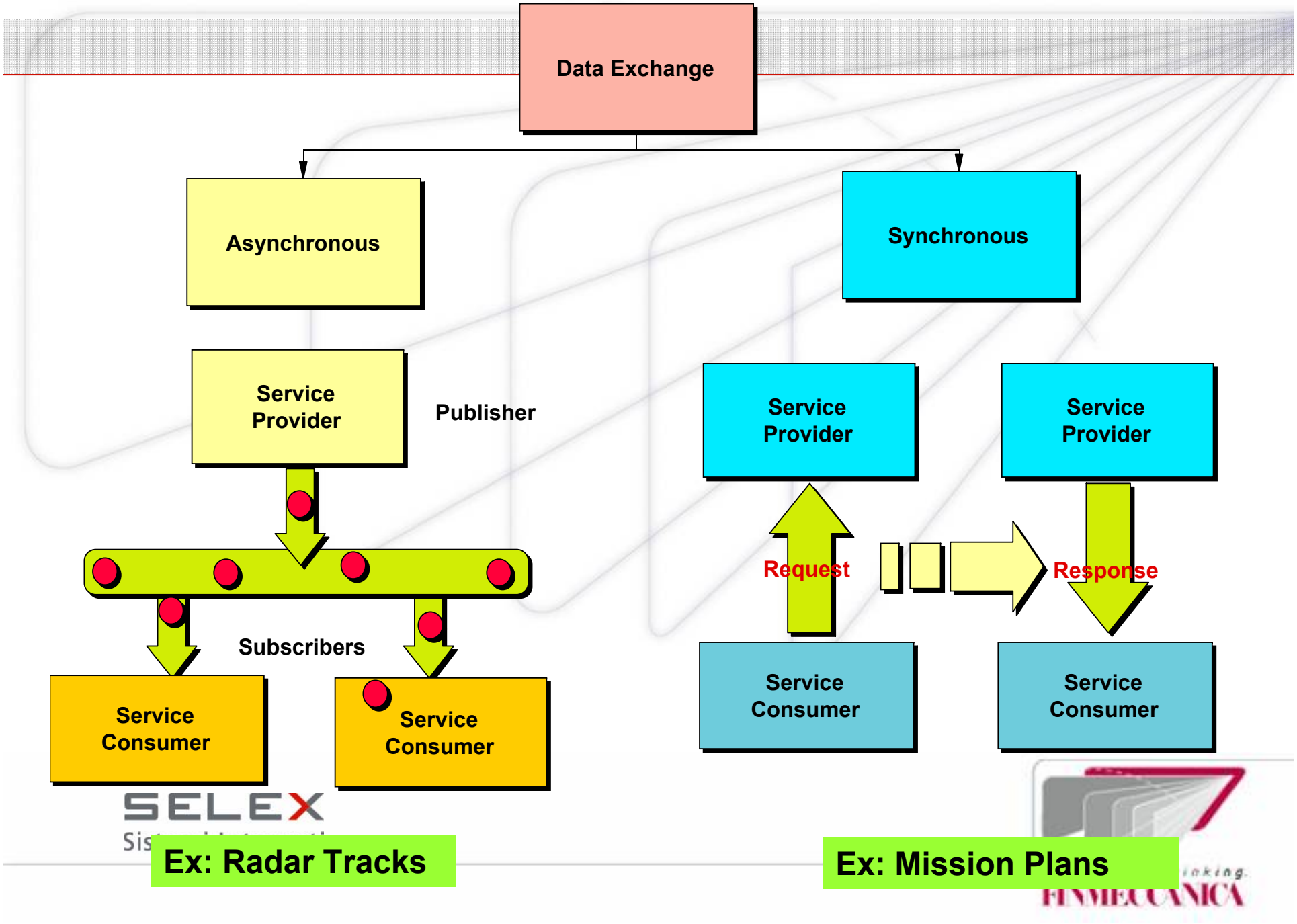
Data Exchange
Asynchronous
Synchronous
Service Provider
Publisher
Subscribers
Service Consumer
Service Consumer
Service Provider
Service Provider
Request
Response
Service Consumer
Service Consumer
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Ex: Radar Tracks
Ex: Mission Plans
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National Borders

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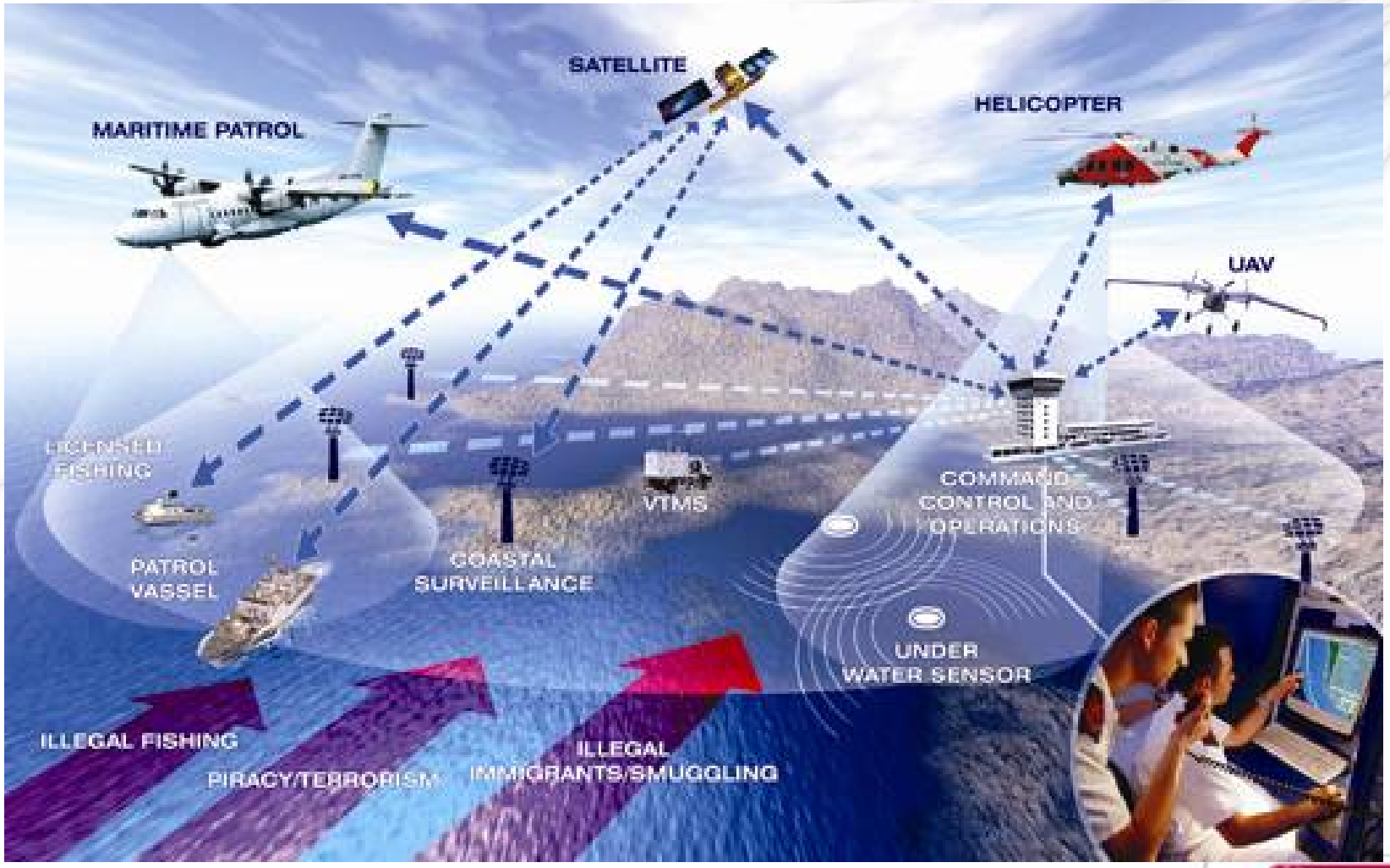
Typical CSS Scenario



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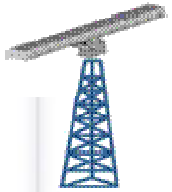
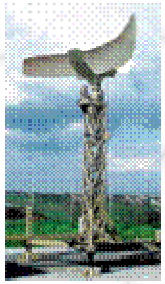
Typical CSS Scenario

CSS: Coastal Border Surveillance System

PORT VTS RADAR



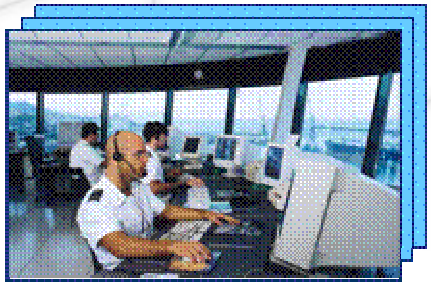
EXTENDED VTS RADAR



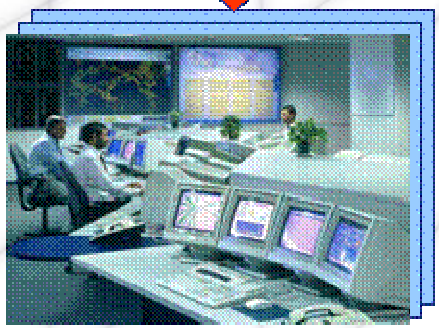
COASTAL RADAR

E/O

NATIONAL CONTROL CENTRE



Local Control Centres



REGIONAL CONTROL CENTRES

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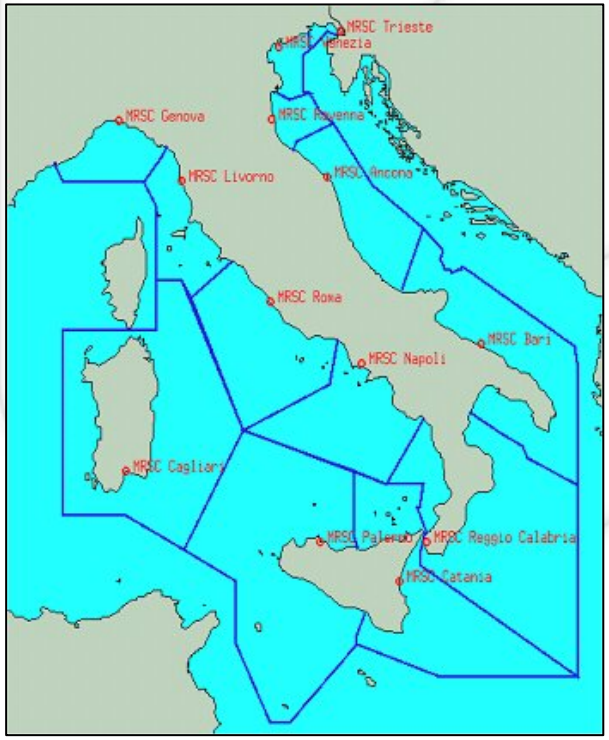
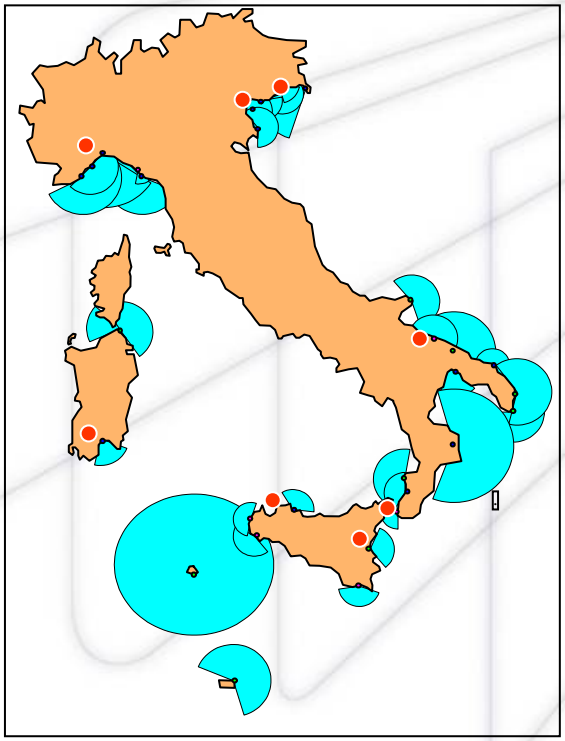
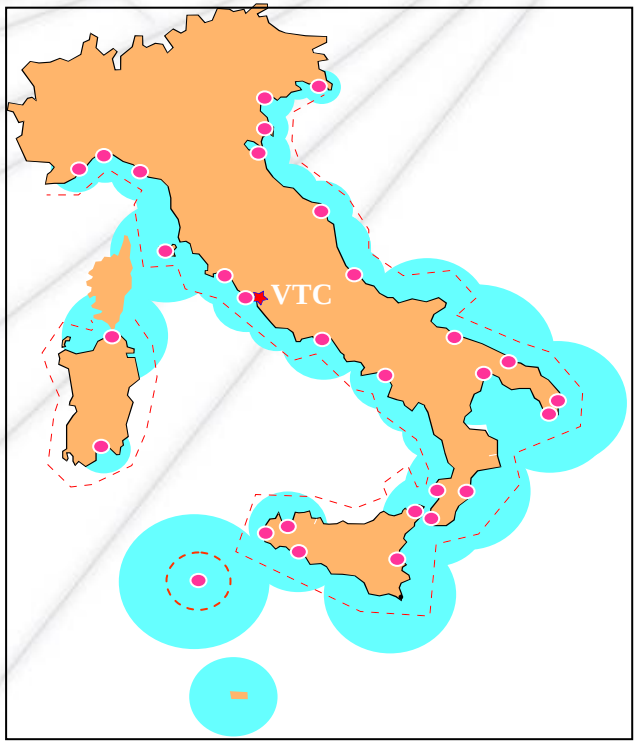
System sensors coverage



The 13 Italian Maritime Directions



The initial coverage



The final coverage

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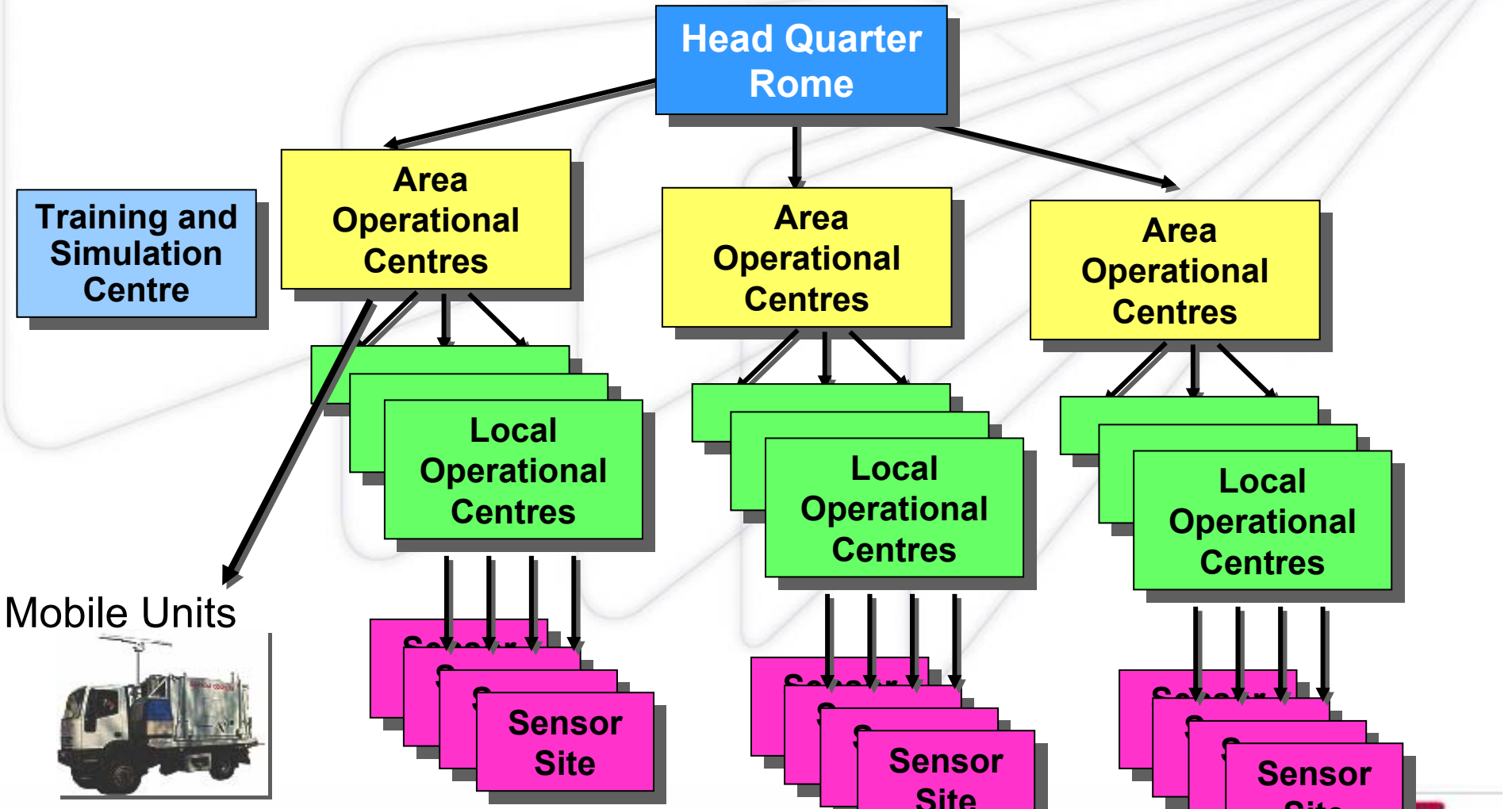
System Configuration



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System Tasks

LOC

- Data fusion of local sensors
- Interaction with traffic within VHF coverage
- Port management
- Local actions planning

AOC

- Fusion of Local Operational Centre data
- Contiguous Hand-over
- Interaction with traffic out of VHF coverage
- SAR planning

HQ

- Nation and world wide traffic image compilation
- Central archive
- Overall SAR coordination

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GENOVA

HEAD QUARTER

TRIESTE

BARI

LA MADDALENA

TARANTO

TRAPANI

GIOIA TAURO

REGGIO CALABRIA

CROTONE

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System Architecture

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General Architecture

Unmanned Remote Sensor Sites

Local Control Centres

Mobile Sensor Sites

Vessels

Port Authority

Shipping Companies

Coast Guard

Pilots

Regional Traffic Centres

SAR Coordination Centre

National Control Centre

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Main Components

✓**Target Detection Sensor:**
- High Resolution Radar
- Automatic Identification System (AIS)
- Radio Direction Finder
- Electro-Optical Video Camera (TV, Low Light TV, I/R)

✓**Voice**
- VHF and HF Radio
- GMDSS

✓**Data Communications**
- Microwave Digital Radio Link
- Dedicated Optical Fibre
- Leased Data Lines

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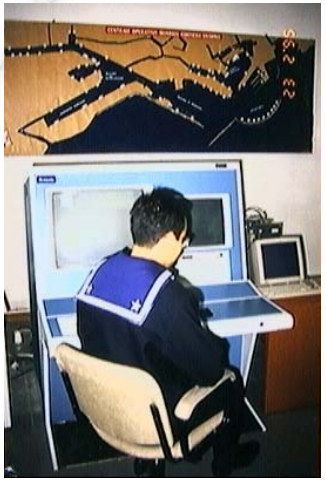
Main Components (continue)

- ✓**Data Processing:**
  - Traffic image build-up through multi sensor correlation
  - Navigation controls
  - Sensor management
  - Data-Base
- ✓**Human-Machine Interface**
  - Traffic image presentation
  - ECDIS
  - Radar raw video
  - TV



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System Functions

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Safety at Sea and Traffic Management

- Prevention of accidents and environment protection
- Navigation rules control
- Support to navigation in narrow waters
- Support to search and rescue
- Port approach control
- Regional traffic control

Prevention of accidents and environment protection

- Collision and Grounding Avoidance
- Support to the operations of pollution cleaning
- Coordination of cleaning means
- Prediction of the drift movement of the floating stains due to winds and currents

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Control of Navigation Rules

- Transit control into zones forbidden to navigation
- Speed limit control
- Traffic Separation Scheme control
- Control of the ships which stop inside zones forbidden to anchorage

Support to Navigation in Narrow Waters

- Control of Traffic Separation Schemes
- Control of safety distance between vessels
- Control of meetings, crossings and over-takings
- Warning at turning points inside navigable fairways
- Traffic direction inside one-way channels
- Blind pilotage

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Support to Search and Rescue

- Detection by radar of small floating objects
- Continue listening on all the radio frequencies assigned by international conventions (SOLAS)
- Radio-Emissions source localization
- Patrol boats and helicopters leading
- Coordination of SAR operations

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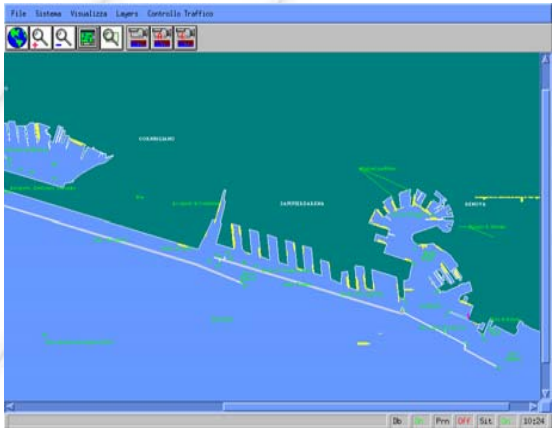
Port Approach Control

- Detection, identification and track of the ships incoming and outgoing
- Collisions and grounding prevention
- Support to pilots
- Information transmission
- Traffic optimization
- Anchored ships and buoy surveillance
- Platform management
- Loading and unloading automatic documentation



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Regional Traffic Control

- Participation to a large area traffic control
  - Send local tracks
  - Receive regional tracks
- Vessel Data Base
- IMO/IALA rules enforcement
- Connection with governmental authorities
- Connection with international authorities
- Strategic Planning and Supervision

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Security and Law Enforcement

- Anti-intrusion coastal surveillance
- Anti-piracy surveillance
- Support to actions of contrast
- Fishery control
- Dangerous cargo monitoring

Anti-Intrusion Coastal Surveillance

- Early detection of small targets in all weather conditions
- Control of transit in forbidden zones
- Un-authorized landings control
- Alarm when two targets merge (likely rendezvous)
- Alarm when a target splits (likely small boat lowered)
- Alarm when a target detected by radar does not reply to AIS
- Cross check of received AIS code against data-base and intelligence

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Anti-Piracy Surveillance

- H24 listening to Security Alert System emergency signals (as per latest SOLAS rules) and localization of call
- Ship tracking and alarm when a track deviates from the planned route
- Alarm when an unidentified track approaches another ship (likely boarding)
- Control of approaches to off-shore platforms

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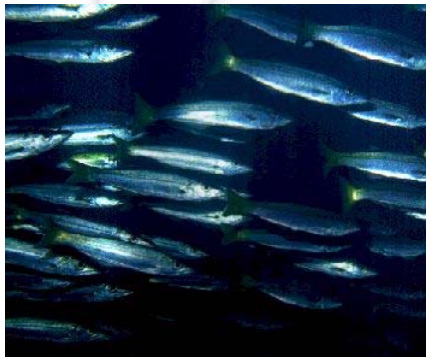
Support to actions of contrast

- Continue knowledge of position and readiness state of all the available means
- Mission planning
- Support to the Coast Guard operations (Aid to the decision process of the operators by simulations of the intercept actions)

Fishery Control

- Identification by means of AIS of domestic fishing ships
- Alarm when an unknown track enters a zone closed to transit
- Alarm when an unknown track moves at low speed inside a fishing reserve
- Same as above, but extended to any un-authorized track, in case of zone protected for environmental **reason**



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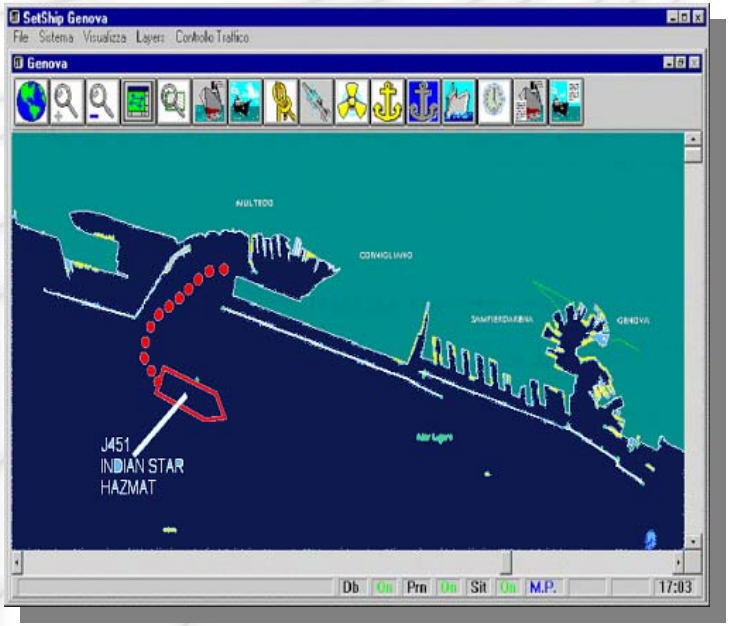
Dangerous Cargo Control

- Tight connection between System and Port Community System (PCS)
- Fully automatic management of all information (from first communication of maritime agent up to HAZMAT data sending to Ministry of Transportation)
- Dangerous cargo tracks are specially marked as long as they stay inside CSS area, tracked and controlled by means of parameters more severe than normal



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Operative Mission Example

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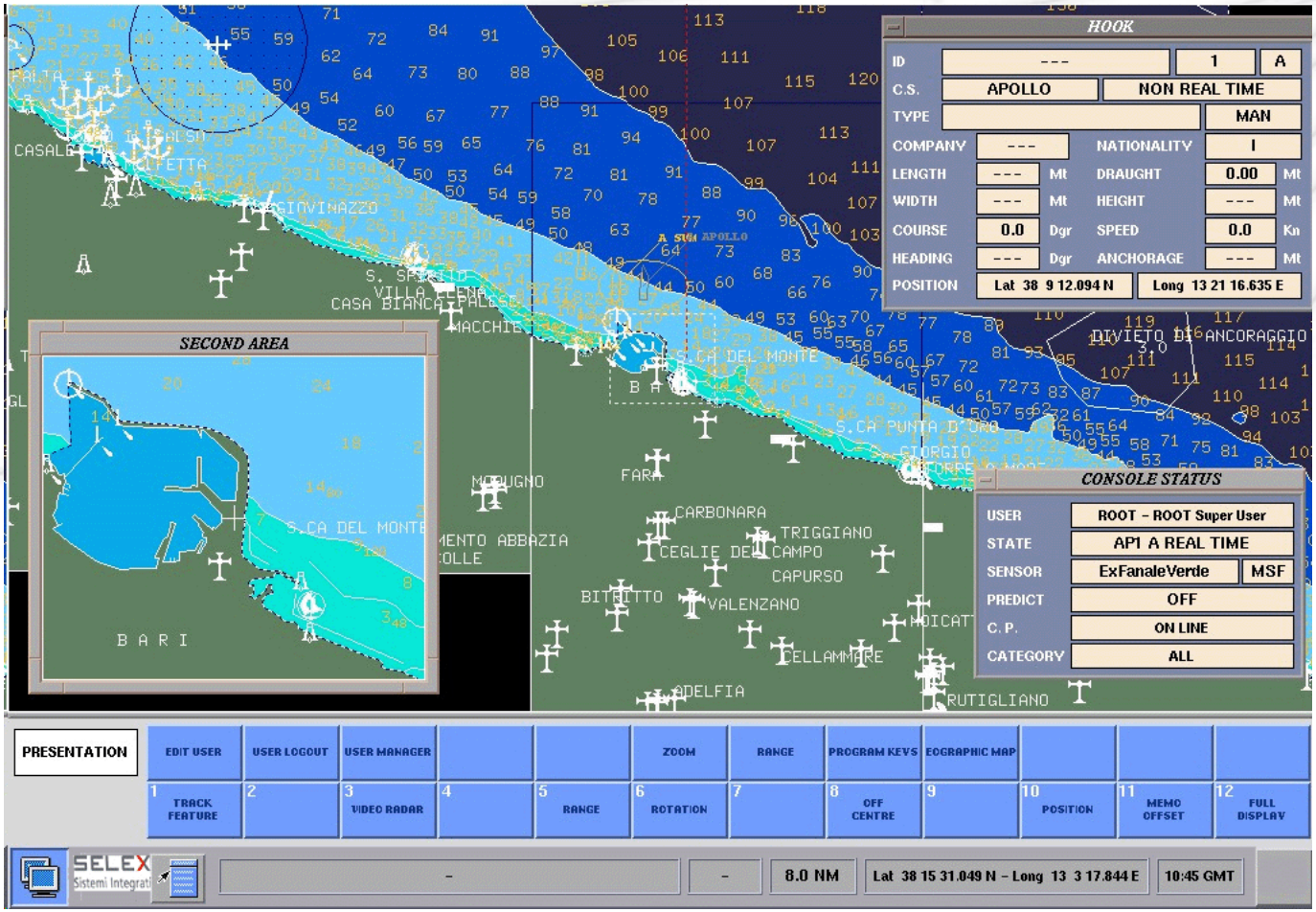
Real System Display



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A MISSION EXAMPLE: *1 - A NEW SEA SURFACE TARGET IS DETECTED*

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A MISSION EXAMPLE: *2 - A NEW SYSTEM TRACK IS INITIALIZED (UNKNOWN)*

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A MISSION EXAMPLE: *3 - AN IDENTIFICATION REQUEST IS SENT TO THE TARGET THAT DOES NOT PROVIDE AN ANSWER*

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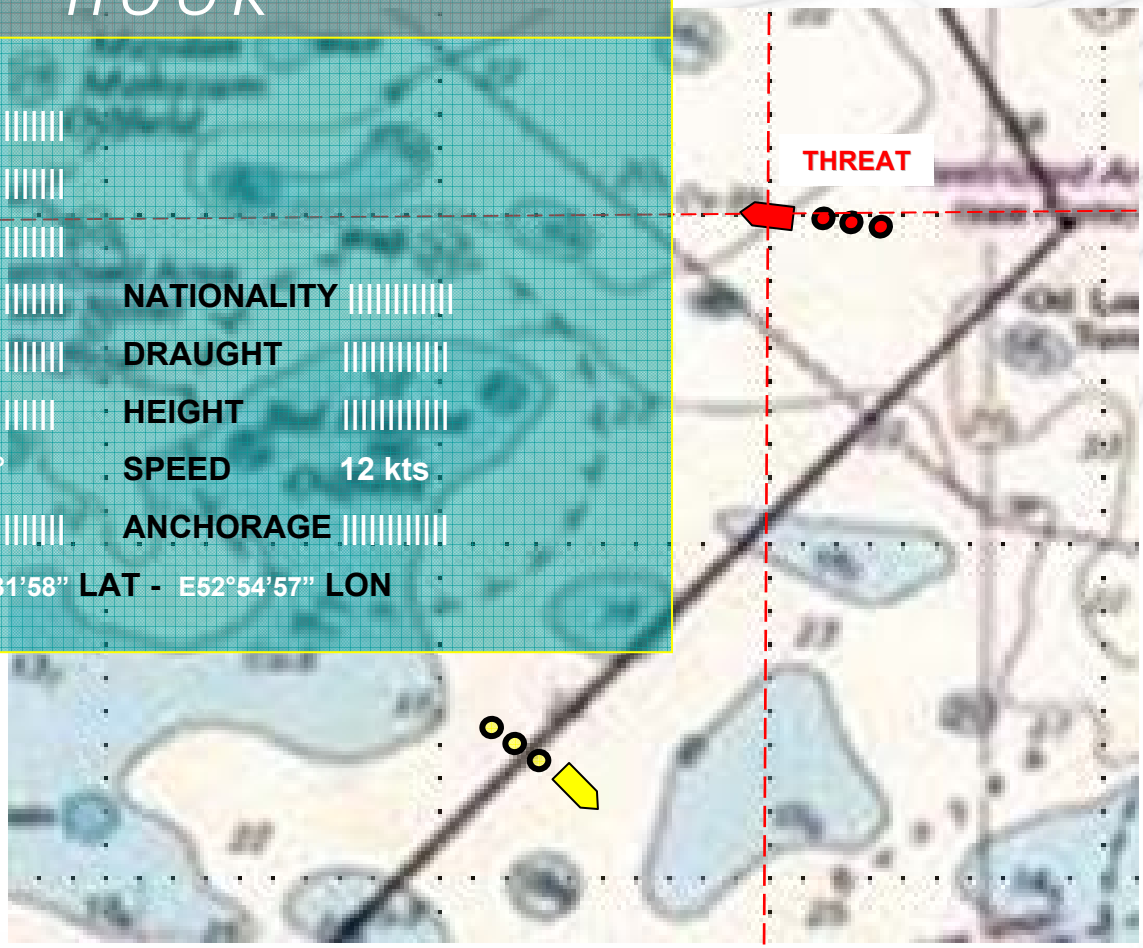
A MISSION EXAMPLE: *4 - THE NOC OPERATOR ARISES AN AIR SUPPORT REQUEST FOR IDENTIFICATION MISSION*

HOOK

ID			
C.S.			
TYPE			
COMPANY		NATIONALITY	
LENGTH		DRAUGHT	
WIDTH		HEIGHT	
COURSE	273°	SPEED	12 kts
HEADING		ANCHORAGE	
POSITION	N25°31'58" LAT - E52°54'57" LON		



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A MISSION EXAMPLE: *5 - THE JOC OPERATORS ASSIGN THE MISSION TO AN HELO SELECTED AMONG THE AVAILABLE ONES*

AIR Support Request

TARGET ID √

SEARCH & RESCUE ☐

SURVEY ☐

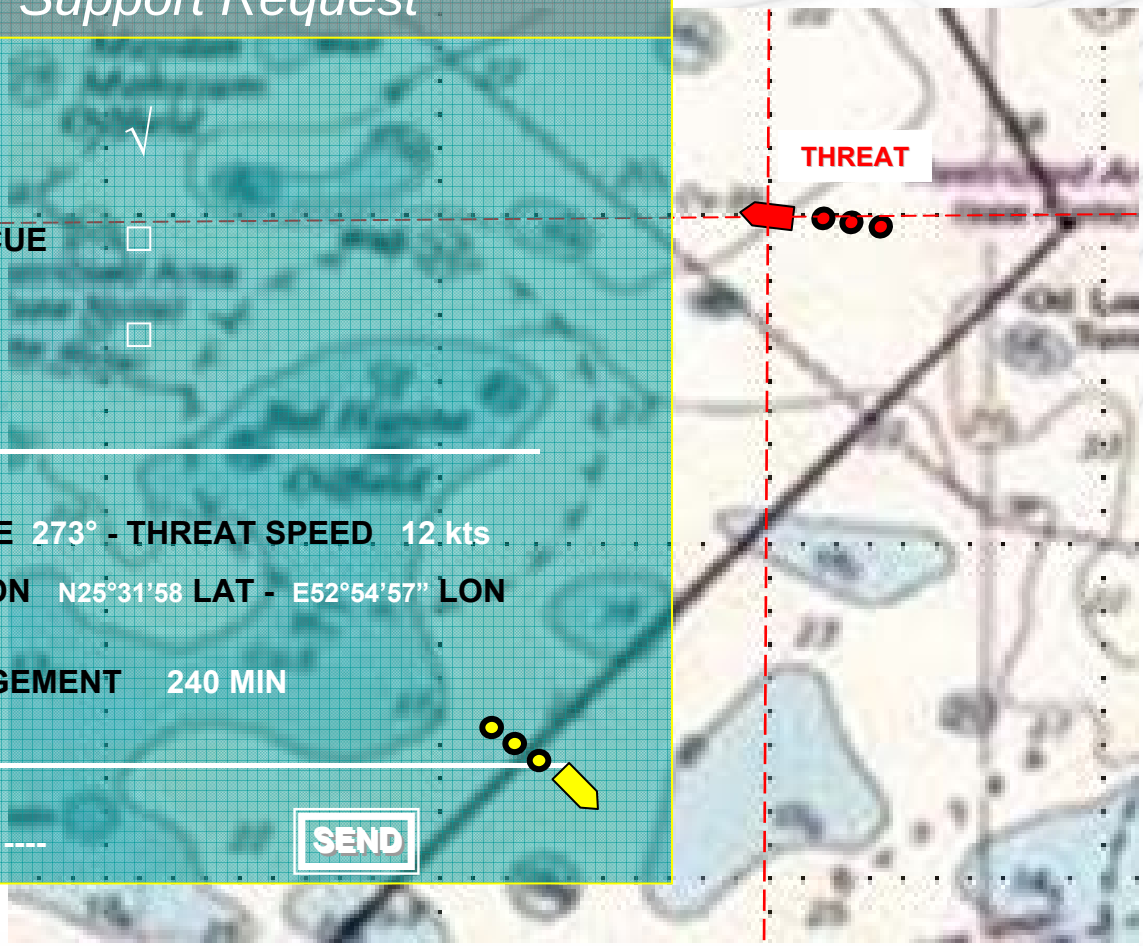
THREAT COURSE 273° - THREAT SPEED 12 kts

THREAT POSITION N25°31'58 LAT - E52°54'57" LON

TIME TO INFRINGEMENT 240 MIN

ACK STATUS → ----

SEND



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A MISSION EXAMPLE: *6 - THE TASKED HELO STARTS FOR THE MISSION*

AIR Support Availability

HELOs	STATUS	LAT LON	AUTONOMY	TIME TO TARGET
1	ON DUTY	N24°44'30" E50°54'28"	300 NM	---
2	IN FLIGHT	N25°19'51" E51°40'54"	280 NM	40 MIN
3	READY 8 MIN	N25°15'50" E51°33'58"	400 NM	52 MIN

COURSE 273° **SPEED** 12 kts

POSITION N25°31'58" LAT - E52°54'57" LON

TIME TO INFRINGEMENT 240 MIN

ACK STATUS → ---- SEND

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A MISSION EXAMPLE: *7 - A VISUAL INSPECTION IS PERFORMED AND THE SUSPICIOUS BEHAVIOUR IS CONFIRMED; THE RELEVANT DATA (IMAGINES INCLUDED) IS REPORTED*

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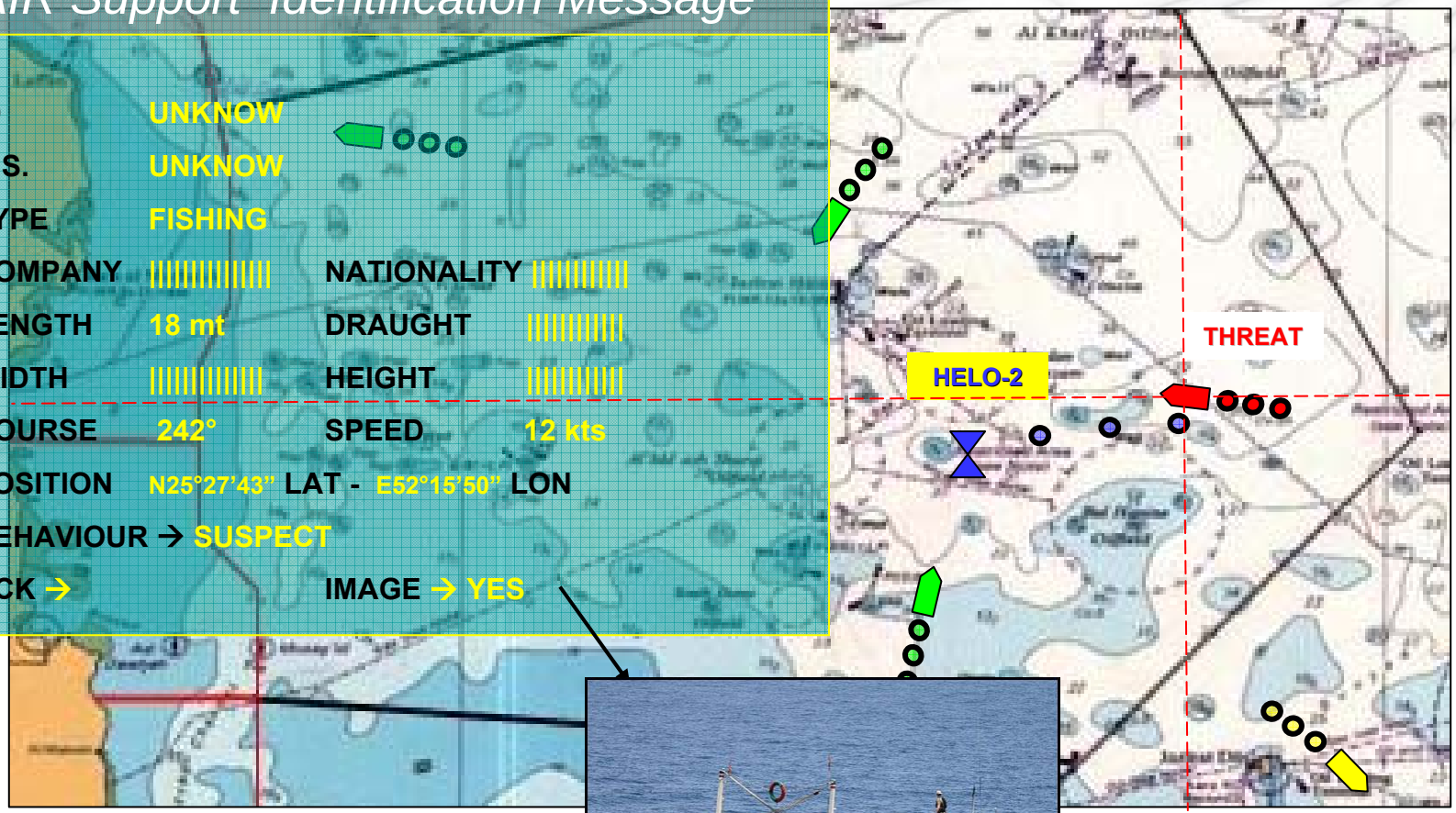
A MISSION EXAMPLE: *8 - THE NOC OPERATOR ARISES A COAST GUARD SUPPORT REQUEST FOR INTERCEPTION MISSION*

AIR Support Identification Message

ID	UNKNOW		
C.S.	UNKNOW		
TYPE	FISHING		
COMPANY	|||||||||||||	NATIONALITY	||||||||||
LENGTH	18 mt	DRAUGHT	||||||||||
WIDTH	|||||||||||||	HEIGHT	||||||||||
COURSE	242°	SPEED	12 kts
POSITION	N25°27'43" LAT - E52°15'50" LON		
BEHAVIOUR → SUSPECT			
ACK →		IMAGE → YES	



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A MISSION EXAMPLE: *9 - THE JOC OPERATORS ASSIGN THE MISSION TO A PATROL BOAT SELECTED AMONG THE AVAILABLE ONES*

Coast Guard Request

TARGET ID

SEARCH & RESCUE ☐

INTERCEPT √

THREAT COURSE 242° - THREAT SPEED 12 kts

THREAT POSITION N25°27'42" LAT - E52°15'50" LON

TIME TO INFRINGEMENT 190 MIN

ACK STATUS → ---- SEND

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A MISSION EXAMPLE: *10 - THE TASKED PATROL BOAT STARTS FOR THE MISSION AFTER A CERTAIN TIME COMPUTED TO THE SCOPE OF OPTIMIZING THE USE OF RESOURCES*

Coast Guard Availability

UNITs	STATUS	LAT LON	AUTONOMY	TIME TO TARGET
6	PATROL 10 MIN	N25°12'45" E51°49'27"	500 NM	75 MIN
9	PATROL 10 MIN	N25°35'07" E51°46'15"	250 NM	71 MIN
11	PATROL 10 MIN	N25°17'32" E51°34'68"	340 NM	60 MIN

COURSE 267° **SPEED** 12 kts

POSITION N25°31'58" LAT - E52°44'57" LON

TIME TO INFRINGEMENT 188 MIN

ACK STATUS → OK **TIME TO START** 70 MIN

GUIDANCE → √ **ORDER SEND**

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A MISSION EXAMPLE: *10 - THE TASKED PATROL BOAT STARTS FOR THE MISSION AFTER A CERTAIN TIME COMPUTED TO THE SCOPE OF OPTIMIZING THE USE OF RESOURCES*

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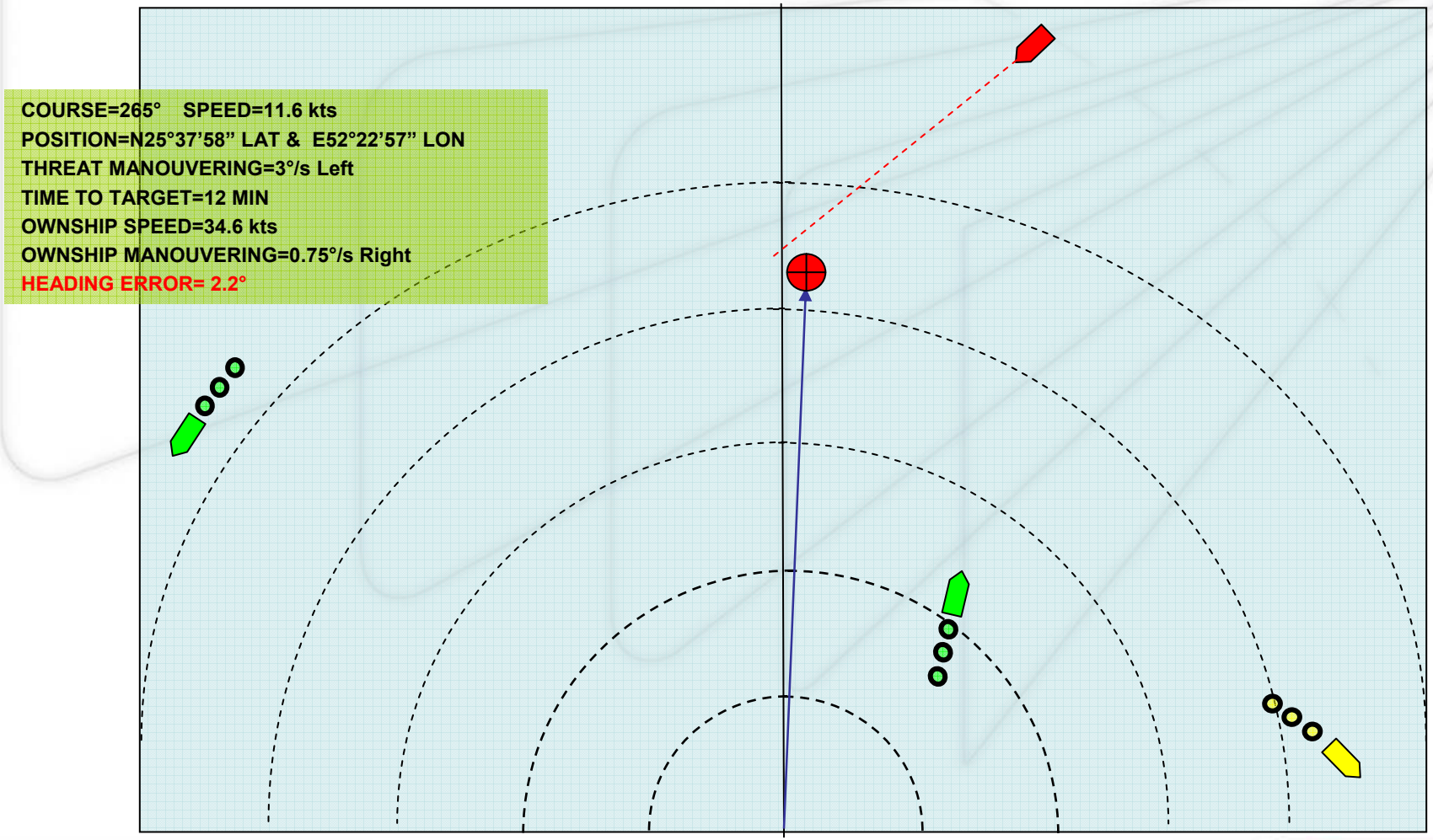
A MISSION EXAMPLE: *11 - A LOCAL CROP IS PROVIDED TO THE INTERCEPTOR FOR PURSUIT GUIDANCE*



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Maritime Border Control

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This paper was received as a PowerPoint presentation, provided in PDF format, without supporting text.

Levato, A. (2006) Maritime Border Control. In *Tactical Decision Making and Situational Awareness for Defence Against Terrorism* (pp. 7-1 – 7-2). Meeting Proceedings RTO-MP-SCI-174, Paper 7 Presentation. Neuilly-sur-Seine, France: RTO. Available from: http://www.rto.nato.int/abstracts.asp.